

In The Drawings

Amend the Drawings as follows:

Replace the informal drawings originally filed with the formal drawings attached and marked as replacement sheets.

REMARKS

Applicant appreciates the thoroughness with which the Examiner has examined the above-identified application. Reconsideration is requested in view of the amendments above and the remarks below.

Drawings objections

Applicant is enclosing formal drawings as replacement for the informal drawings originally filed. No new matter has been added.

Specification objections

Applicant has amended the title as suggested by the Examiner.

Applicant has made the amendments to paragraphs 0005, 0018 and 0024 as suggested by the Examiner, and support is found in these paragraphs.

Applicant has amended the language of the specification in paragraphs 0024 and 0028 to refer to substrate base 20, and to refer to the "substrate" in paragraph 0024 as having base 20 overlaid with phase shifting material 22 and opaque material 24. Support is found in originally filed paragraph 0011.

No new matter has been added by these amendments.

Rejection under 35 USC § 112, first paragraph

Claims 1-20 stand rejected for not enabling one to make "embedded" attenuated phase shift masks (EAPSMs). However, as is well known, the term "embedded" refers to the incorporation of an opaque layer, such as chromium, in the mask along with the phase shifting material. This is explained in the specification at paragraph 0005, wherein it is stated:

Other PSMs for example, embedded attenuated phase shift masks (EAPSMs), utilize opaque layers of chromium to mask non-critical areas outside of the critical structure areas.

The formation and incorporation of opaque material such as chromium is described throughout the specification and drawings. Accordingly, applicants submit that the term "embedded attenuated phase shift masks" is fully enabled in the application.

Rejection under 35 USC § 112, second paragraph

As discussed above, applicant has amended the specification in paragraph 0024 to refer to the "substrate" as having base 20 overlaid with phase shifting material 22 and opaque material 24. This is in conformance with the language used in the claims, and, accordingly, it is believed that no claim amendments are necessary with regard to the term "substrate."

Applicant has also corrected the typographical error for the acronym "EAPSM" in claims 8, 9, 15 and 18. In claim 8, applicant has also changed "the same mask set" to "a same mask set." No new matter has been added.

Rejection under 35 USC § 102

Claims 1 and 3 stand rejected under 35 USC § 102 as being anticipated by Tzu U.S. Patent No. 6,423,455. Applicant respectfully traverses this rejection.

Claim 1 of the present invention is directed to a method of making an embedded attenuated phase shift mask (EAPSM) that creates first level phase shifting image segments on a substrate corresponding to areas of critical structures to be exposed, and which employs a single frame exposure mask corresponding to non-critical areas outside the critical structure areas. The substrate has a layer of phase shifting material and a layer of an opaque material. The method uses a first resist layer on the substrate to create first level phase shifting image segments on the substrate

corresponding to areas of critical structures to be exposed with the EAPSM. The method then deposits a second resist layer on the substrate and uses the single frame exposure mask to expose and develop the second resist layer. The method then includes etching the substrate to remove the opaque material from the critical structure areas.

The Tzu patent cited by the Examiner does not distinguish between portions of the phase shift mask substrate used for critical structures and those portions corresponding to non-critical areas outside the critical structures areas. Tzu discloses only the use of one resist layer (26) to create the phase shifting mask, and does not employ a second resist layer. More importantly, the Tzu patent does not disclose the use of a single frame exposure mask, corresponding to non-critical areas outside the critical structure areas, to expose a second resist layer to ultimately remove the opaque material from the critical structure areas. What the Examiner refers to in Fig. 5 as the "second resist" (Office Action, p.7) is actually the same resist layer as shown in Figs. 2-4. Thus, Tzu does not anticipate the invention as recited in claim 1.

Applicant's claim 3 is dependent on claim 1, and is not anticipated by Tzu for the same reasons.

Rejection under 35 USC § 103

Claims 2 and 12

Claims 2 and 12 stand rejected under 35 USC § 103 as being obvious from Tzu alone or in view of Glendinning U.S. Patent No. 4,797,334. Applicant respectfully traverses this rejection.

Claim 2 is dependent on claim 1, and recites that the first resist layer is exposed by use of a direct write electron beam or laser energy source, and the second resist layer is exposed by an energy source other than the energy source used to expose the first resist layer. Independent claim 12 is similar to claim 1, and recites that the first resist layer is exposed with a direct write electron beam or laser energy source and the second resist layer is exposed by simultaneous projection exposure.

Tzu discloses that the radiation used with mask 28 to expose resist layer 26 is a "flood radiation" but does not disclose that electron beam or laser is used to first expose another resist layer other than layer 26. Tzu discloses no use of any other resist layer, and therefore cannot suggest use of any first and second resist layers that applicant employs in his claimed method, or the use of a different exposure method for that different resist layer. Glendinning likewise discloses no two-resist layer method for making EAPSMs, and therefore his disclosure of electron beam radiation is irrelevant and does not make up for the deficiencies of the Tzu patent.

As such, applicant's claims 2 and 12 are not obvious to one of ordinary skill in this art.

Claims 4, 8 and 9

Claims 4, 8 and 9 stand rejected under 35 USC § 103 as being obvious from Tzu or in view of either Chiang U.S. Patent No. 4,343,877 or Irie U.S. Patent No. 6,710,847. Applicant respectfully traverses this rejection.

Claim 4 is dependent on claim 1, and recites that the method further includes identifying and storing the single frame exposure mask for future use with the EAPSM. Claim 8, dependent on claim 4, states that the single frame exposure mask is identified and stored with other EAPSMs in a same mask set as the EAPSM. Claim 9, dependent

on claim 3, recites that the single frame exposure mask is identified and stored for future use having the same chip or field size as the EAPSM. As claimed in the base claim, claim 1, the single frame exposure mask corresponds to non-critical areas outside the critical structure areas, i.e., active regions that form an integrated circuit device or portion thereof as defined in the specification.

Applicant's invention as defined in claims 4, 8 and 9 has the advantage, not found in the prior art, of simplifying the second resist level exposure to remove unwanted chrome image segments from the mask by reducing the time for employing laser or electron beam tools, the latter of which may be limited to the exposure of the first resist layer.

Tzu discloses and suggests nothing about a mask that corresponds to non-critical areas outside such critical structure areas, or to its use to expose a second resist layer. Neither Chiang nor Irie disclose the re-use of such single frame exposure masks or their use to expose a second resist layer in making EAPSMs in a two- exposure process. Applicant respectfully submits that any suggestion of the present invention is only the result of hindsight reconstruction based on applicant's own specification, and would not be obvious to one skilled in the art from Tzu in combination with Chiang or Irie.

Claims 5, 6 and 7

Claims 5, 6 and 7 stand rejected under 35 USC § 103 as being obvious from Tzu in view of either Chiang or Irie and further in view of Aita U.S. Patent No. 5,405,734. Applicant respectfully traverses this rejection.

Claims 5, 6 and 7 specify that the single frame exposure mask is used to remanufacture the EAPSM where the EAPSM is reworked, damaged or redesigned, respectively.

The Examiner acknowledges that neither Tzu, Chiang or Irie disclose such remanufacture using the single frame exposure mask in applicant's claimed invention, and cites Aita for such subject matter. However, Aita uses no single frame exposure mask to repair any type of lithographic mask, let alone an EAPSM. Instead, Aita uses a focused ion beam (1) to remove excess patterning film. Therefore, one of ordinary skill would not consider obvious applicant's invention as defined in claims 5, 6 and 7.

Claims 10 and 11

Claims 10 and 11 stand rejected under 35 USC § 103 as being obvious from Tzu or in view of either Narushima U.S. Patent No. 6,549,277 or Inao U.S. Patent Publication No. US 2001/0036581. Applicant respectfully traverses this rejection.

Claims 10 and 11 specify reduction ratio using the single frame mask, and are dependent from claim 1. The additional cited art, Narushima or Inao, in combination with Tzu do not disclose the invention of claim 1, and therefore claims 10 and 11 are not obvious to one skilled in the art for the reasons given above in connection with claim 1.

Claims 13, 15, 18 and 20

Claims 13, 15, 18 and 20 stand rejected under 35 USC § 103 as being obvious from Tzu alone or additionally in view of Glendinning, further in view of either Chiang or Irie. Applicant respectfully traverses this rejection.

Claim 13 recites the same subject matter as claim 4, and is dependent on claim 12, and is not obvious for the same reasons as given in connection with claims 4 and 12.

Claim 15 combines the subject matter of claims 8 and 9, and is dependent on claim 13, and is not obvious for the same reasons as given in connection with claims 8, 9 and 13.

Independent claim 18 combines the subject matter of claim 1 with subject matter in claims 2 and 15, and is not obvious for the same reasons as given in connection with those claims.

Claim 20 recites the same subject matter as claim 3, and is dependent on claim 18, and is not obvious for the same reasons as given in connection with claims 3 and 18.

Claims 14 and 19

Claims 14 and 19 stand rejected under 35 USC § 103 as being obvious from Tzu alone or additionally in view of Glendinning, further in view of either Chiang or Irie, and further in view of Aita. Applicant respectfully traverses this rejection.

Claims 14 and 19 both combine the subject matter of claims 5, 6 and 7, and are dependent on claims 13 and 18, respectively. They are not obvious for the same reasons as given in connection with claims 5, 6, 7, 13 and 18.

Claims 16 and 17

Claims 16 and 17 stand rejected under 35 USC § 103 as being obvious from Tzu alone or additionally in view of Glendinning, further in view of either Narushima or Inao. Applicant respectfully traverses this rejection.

Claims 16 and 17 each recite the same subject matter as claims 10 and 11, and are dependent on claim 12. They are not obvious for the same reasons as given in connection with claims 10, 11 and 12.

It is respectfully submitted that the application has now been brought into a condition where allowance of the entire case is proper. Reconsideration and issuance of a notice of allowance are respectfully solicited.

Respectfully submitted,




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CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service on the date indicated below as first class mail in an envelope addressed to the Mail Stop Amendment Commissioner for Patents, P.O. Box 1450, Alexandria, VA 2231301450.

Name: Barbara Browne Date: September 29, 2006 Signature: 

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